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REVIEWS.

SUMMARIES OF THE LITERATURE OF ECONOMIC GEOLOGY.

I.

EDWIN C. ECKEL.

WITH the present issue the title of this section has been changed to conform to an enlargement in its scope. A brief outline of the plan which the writer purposes to follow may be of service to readers.

Papers and books relating to the economic geology of the United States will be summarized, so far as possible. Discussions of economic developments in foreign countries will be excluded, unless containing matter of general interest. Publications devoted largely or entirely to the technology of any mineral industry will not be summarized; but as such technologic papers appear to be of increasing interest to workers in economic geology, they will be listed by title, with occasionally a brief note to indicate their scope. Reports or papers containing statistical or compiled data only will be neither summarized nor listed.

The expansion of the scope of this series of summaries will necessitate the exclusion from it of many papers which would have been noticed under the old arrangement. The writer has planned, therefore, to continue the old series in *Municipal Engineering*, under the title "Recent Publications on Structural Materials."

ADAMS, G. T. "Principles Controlling the Geologic Deposition of the Hydrocarbons." *Trans. Am. Inst. Min. Eng.*, Vol. XXXII; advance separate, 7 pp.

The author notes the present unsatisfactory condition of the literature on the hydrocarbons, in so far as their geologic interlation and the principles governing the origin of their economically valuable deposits are concerned; and applies to these problems certain principles allied to those stated by Van Hise for ore deposits. The principal difference, in this regard, between hydrocarbons and ores is that the latter are carried in solution, while the former are largely associated with the transporting water merely in a condition of mechanical mixture. The author then discusses the effect of the inferior specific gravity of the hydrocarbons, as compared with water; the different effects which will be produced, according as the hydrocarbon is merely miscible with, or soluble in, the transporting water; and the possibility that separations of the hydrocarbons, equivalent to those accomplished by fractional distillation, may be effected by differences in degrees of solubility, or in the character of the rock traversed.

BRANNER, J. C., AND NEWSOM, J. F. *The Phosphate Rocks of Arkansas*. Bull. 74, Arkansas Agric. Exp. Station. 8vo, 67 pp.

Three phosphate-bearing areas are noted in Arkansas. The first, and by far the most important, lies north of the Boston Mountains and west of Black River; the second, in the Cretaceous area of the southwestern part of the state; the third, north and west of Hot Springs. The second and third areas may be dismissed with the remark that little appears to be known concerning the phosphate beds they may contain.

The principal area is that in the northern part of the state. The phosphates here occur as nodules associated with the Sylamore sandstone and Eureka shale. These two formations together have a maximum thickness of 90 feet, and represent the Devonian of the region. The phosphates are therefore at the same horizon as the Tennessee black phosphates. Average specimens gave a phosphoric acid content equivalent to 30 per cent. to 70 per cent. calcium phosphate, with 4 per cent. to 20 per cent. iron and alumina. Unless better material is found, the rock will evidently be unable to compete, except locally, with Tennessee or other southern phosphates.

CROSBY, W. O. "Geological History of the Hematite Iron Ores of the Antwerp and Fowler Belt in New York." *American Geologist*, Vol. XXIX, pp. 233-42; also in *Technology Quarterly*, Vol. XIV, pp. 162-70.

The author discusses certain of the red hematite deposits of the western Adirondacks and concludes that the "ore body of the Sterling mine is in a dike, 50 feet or more in width, of some highly altered basic rock, possibly diabase; that the ore was originally a magmatic segregation of this rock, chiefly in the form of sulphides, which have subsequently suffered more or less complete oxidation to a considerable depth, the ore now being virtually a gossan; and that this dike is, probably, continuous for the entire length of the belt of mines, although absolute continuity is by no means essential to the hypothesis."

[It will be remembered that the "dike" in which the ore bodies occur is bordered by granite on the southeast, and by crystalline limestone on the northwest; and that Smyth has considered the chloritic "dike" rock to be merely a highly altered phase of the granite.]

DICKSON, C. W. "The Ore Deposits of Sudbury, Ontario." *Trans. Am. Inst. Min. Eng.*, Vol. XXXII; advance separate, 65 pp.

The first part of this paper deals with "The Relation of Nickel to Pyrrhotite." The mineral associates, chemical composition, and nickel and cobalt content of pyrrhotites are discussed, particular attention being paid to the Sudbury and Algoma ores. The author states that "the nickel occurs in the pyrrhotite as the so-called pentlandite," but that, though "nearly all of the pentlandite can be separated from the pyrrhotite by magnetic methods," "peculiar physical conditions seem to render its absolute elimination an impossibility." Magnetic separation is therefore a commercial impossibility. The further conclusion is reached that the Sudbury pyrrhotite conforms best to the formula Fe_8S_9 .

The second part is entitled "Genesis of the Sudbury Ores," but contains in addition much material bearing on other districts. The Sudbury deposits and ores are discussed in detail, and the author concludes that the origin of the deposits is to be referred to replacement of the basic rock along crushed and faulted zones, and not to magmatic segregation. This conclusion is based upon the following line of argument:

Brecciation, with accompanying faulting and shearing, is noticeable both on a

large scale and in slides. Most of this took place prior to the formation of the ore deposits, and the ore prevailingly occurs as a cement for the brecciated rock-fragments and along shearing planes. All the rock is now more or less altered; and the more complete the alteration of the rock, the more complete has been its replacement by ore. Pyrrhotite occurs, it is true, as an original constituent of the norite, but the amount of this original pyrrhotite is very small. The abrupt change from massive sulphides to barren rock, the angular form of the included rock fragments, and the comparative freedom from sulphides of these fragments are further adduced in support of the theory that the ore deposits are essentially and predominantly secondary.

FLUKER, W. H. "Gold Mining in McDuffie County, Georgia." *Trans. Am. Inst. Min. Eng.*, Vol. XXXII; also in *Eng. and Min. Jour.*, Vol. LXXIII, pp. 725, 726.

Of particular interest as describing a Georgia gold-mining district never before discussed in print, and far to the southeast of what is commonly considered the Georgia gold region. The veins carrying the auriferous pyrite are of the usual Appalachian type—stringers usually parallel to the lamination of the inclosing mica and hydromica schists.

HILL, B. F. *The Terlingua Quicksilver Deposits, Brewster County [Texas]*. Bull. 4, Univ. of Texas Mineral Survey. 8vo, pp. 74.

The rocks in the vicinity of the Brewster county quicksilver deposits are marine sediments representing the Lower and Upper Cretaceous and the Tertiary, with igneous rocks of late Tertiary age. The ores occur in the Cretaceous beds occupying fissures, either vertical or along bedding planes, marked by little or no displacement; and fault fissures marked by displacement with or without brecciated zones. Ore deposition in the district is supposed to have been due to the stimulus of the late Tertiary intrusions and flows. The common ores are cinnabar and native mercury, though other mercury ores occur in small quantity. The chief gangue material is calcite; aragonite and gypsum being next in importance.

MCCALLIE, S. W. "The Ducktown Copper Mining District." *Eng. and Min. Journ.*, Vol. LXXIV, pp. 439, 440.

Description of the geography, areal geology, and ore deposits of the Ducktown district of southeastern Tennessee and its extension into northern Georgia. The original contribution of greatest interest in this paper is the determination of the occurrence of sheared igneous rocks in the vicinity of the ore bodies, a dark gray quartz diorite occurring in linear areas parallel with the trend of the ore deposits.

PRATT, J. H. "Gold Mining in the Southern Appalachians." *Eng. and Min. Journ.*, Vol. LXXIV, pp. 241, 242.

Summary of recent gold-mining developments in Virginia, North Carolina, South Carolina, Alabama, and Tennessee.

SPURR, J. E. "The Original Source of the Lake Superior Iron Ores." *American Geologist*, Vol. XXIX, pp. 335-49.

The author points out that, though Van Hise and Leith agree with him in considering the original source of the Mesabi ores to be a green hydrous ferrous silicate of organic origin, they refuse to call this material glauconite, because of its low content or entire lack of potash. Spurr gives analyses and descriptions of undoubted glauconites from various localities, comparing these with the Mesabi material. He decides that, though the Mesabi silicate carries less potash (0.31 per cent. and 0.41 per cent.)

than any of the others, it is nearer the Australian (less than 1 per cent.), the Paris basin (1.70 per cent.), and the French Creek, Pa. (2.23 per cent.) glauconites than they are to the Grodno, Russia, material (7.57 per cent.). Recalling Murray and Renard's observation that the potash content of recent glauconites depends largely on the composition of the coastal rocks, he shows that the surface, at the time of deposition of the Mesabi iron-bearing formation, consisted of rocks very low in potash. His final conclusion, therefore, is that the Mesabi mineral is entitled to the name glauconite.

SPURR, J. E. "A Consideration of Igneous Rocks and Their Segregation or Differentiation as Related to the Occurrence of Ores." *Trans. Am. Inst. Min. Eng.*, Vol. XXXII, advance separate, 53 pp.

The author discusses briefly the general relation of ore deposits to igneous rocks, pointing out that the ores were all originally derived from igneous rocks, and that most existing ore deposits are closely associated with areas or belts of such rocks. The sedimentary rocks, as a rule, contain a lower percentage of the metals than do rocks of igneous origin.

The differentiation of igneous rocks is then discussed, and the order in which the various minerals crystallize out of a molten magma is noted. The concentration of commercially valuable minerals by segregation within molten masses previous to their consolidation, is discussed in some detail, the metals being separately treated. The preference of concentrations of iron, chromium, nickel, copper, platinum (and probably cobalt) for the more basic igneous rocks, and that of molybdenum, tin, and tungsten for the acid rocks, is stated.

The author then takes up an original contribution to the study of ore deposits—the general preference of gold for the more siliceous igneous rocks, and the relationship of certain gold quartz veins to rocks of undoubted igneous origin. Studies in certain Alaskan and other districts have convinced him that many gold-quartz veins are to be regarded simply as extremely acid igneous rocks—the result of magmatic segregation—and correlative to the extremely basic rocks (pyroxenites, etc.) at the other end of the series. This theory is discussed in detail, and supporting observations, drawn from various districts, are given. This portion of the paper is summarized by the author in the statement that "although gold is present in all igneous rocks, and may be unequally distributed in any of them, yet the conditions for concentration by magmatic segregation become more favorable in proportion as the rock becomes more siliceous, and become *most* favorable in what has been shown to be the extreme siliceous product of rock-differentiation—in quartz-veins or dykes."

The merging of deposits formed by magmatic segregation into certain types of contact-deposits, and into deposits of gaseo-aqueous origin, is noted. The sequence of rock types in the volcanic eruptions of an area is then discussed, leading up to the relations between this sequence and the sequence of metalliferous deposits in the same area. The conclusion is then drawn that "by magmatic segregation the metals of commercial value, as well as the commoner rock-forming elements, are irregularly and to a certain extent independently concentrated in certain portions of the earth's crust. Such portions, characterized by the relative abundance of certain metals, may be called metalliferous provinces." These "metalliferous provinces" may be more or less closely identified with the different "petrographic provinces."